

[a first step of] forming an amorphous semiconductor film
[containing] comprising silicon [on] over a substrate having an
insulating surface;

[a second step of] introducing into the amorphous
semiconductor film [a catalyst] an element [for promoting] which
promotes crystallization of the amorphous semiconductor film;

[a third step of] crystallizing the amorphous semiconductor
film by a heat treatment;

A1 cont
[a fourth step of selectively] introducing an impurity
element belonging to Group 15 into at least one region selected
in [silicon-containing] the crystallized semiconductor film
obtained [in the third step of] by crystallizing the amorphous
semiconductor film [an impurity element belonging to Group 15];
[and]

[a fifth step of] gettering the [catalyst] element which
promotes crystallization by heat treatment to the region into
which the impurity element is introduced[,]; and

patterning said crystallized semiconductor film into
island-shape thereby removing said region to which the impurity
element is introduced,

wherein the heat treatment [in the fifth step] during
gettering the element which promotes crystallization is

performed in [the] ~~a~~ temperature range not exceeding a glass transition point of the substrate.

Amend
2. (Amended) A method according to claim 1, wherein [the silicon-containing] a semiconductor film obtained [in the third step] by crystallizing the amorphous semiconductor film is a crystalline semiconductor film having grain boundaries.

3. (Amended) A method according to claim 1, wherein the heat treatment [in the fifth step] during gettering is performed in the temperature range from [550] 500 to [650] 700°C.

Sub B2
4. (Amended) A method according to claim 1, wherein the heat treatment during gettering is furnace annealing.

A2
5. (Amended) A method according to claim 1, wherein the [silicon-containing] amorphous semiconductor film [contains] comprises germanium.

6. (Amended) A method according to claim 1, wherein the [catalyst] element which promotes crystallization is at least one element selected from the group of elements consisting of Ni, Co, Fe, Pd, Pt, Cu and Au.

80B3 9. (Amended) A method of manufacturing a semiconductor device, comprising:

[a first step of] forming an amorphous semiconductor film [containing] comprising silicon [on] over a substrate having an insulating surface;

A3 [a second step of] selectively introducing into the amorphous semiconductor film [a catalyst] an element [for promoting] which promotes crystallization of the amorphous semiconductor film;

[a third step of] crystallizing at least a part of the amorphous semiconductor film by a heat treatment;

[a fourth step of selectively] introducing an impurity element belonging to Group 15 into at least one region selected in [silicon-containing] the crystallized semiconductor film obtained [in the third step of] by crystallizing at least a part of the amorphous semiconductor film [an impurity element belonging to Group 15]; [and]

[a fifth step of] gettering the [catalyst] element which promotes crystallization by a heat treatment to the region into which the impurity element is introduced[,]; and

patterning said crystallized semiconductor film into island-shape thereby removing said region into which the impurity element is introduced,

wherein the heat treatment [in the fifth step] during gettering the element which promotes crystallization is performed in [the] a temperature range not exceeding a glass transition point of the substrate.

13 end
10. (Amended) A method according to claim 9, wherein [the silicon-containing] a crystallized semiconductor film obtained [in the third step] by introducing an impurity element belonging to Group 15 is a crystalline semiconductor film having grain boundaries.

11. (Amended) A method according to claim 9, wherein the heat treatment [in the fifth step] during gettering the element which promotes crystallization is performed in the temperature range from [550] 500 to [650] 700°C.

Sub
A-1 B4
13. (Amended) A method according to claim 9, wherein the heat treatment during gettering is furnace annealing.

14. (Amended) A method according to claim 9, wherein the [silicon-containing] amorphous semiconductor film [contains] comprises germanium.

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15. (Amended) A method according to claim 9, wherein the [catalyst] element which promotes crystallization is at least one element selected from the group of elements consisting of Ni, Co, Fe, Pd, Pt, Cu and Au.

Subs
17. (Amended) A method of manufacturing a semiconductor device, comprising:

[a first step of] forming an amorphous semiconductor film [containing] comprising silicon [on] over a substrate having an insulating surface;

As
[a second step of] introducing into the amorphous semiconductor film [a catalyst] an element [for promoting] which promotes crystallization of the amorphous semiconductor film;

[a third step of] crystallizing the amorphous semiconductor film by a heat treatment;

[a fourth step of] irradiating a laser light or an intense light to [silicon-containing] the crystallized semiconductor film obtained in the [third] step of crystallizing the amorphous semiconductor film;

[a fifth step of selectively] introducing an impurity element belonging to Group 15 into at least one region selected in [silicon-containing] the semiconductor film obtained [in the fourth step of] by irradiating a laser light or an intense light [an impurity element belonging to Group 15]; and

[a sixth step of] gettering the [catalyst] element which promotes crystallization by a heat treatment to the region into which the impurity element is introduced,

wherein the heat treatment [in the sixth step] during gettering is performed in [the] a temperature range not exceeding a glass transition point of the substrate.

18. (Amended) A method according to claim 17, wherein [the silicon-containing] a crystallized semiconductor film obtained [in the third step] by crystallizing the amorphous semiconductor film is a crystalline semiconductor film having grain boundaries.

19. (Amended) A method according to claim 17, wherein the heat treatment [in the fifth step] during gettering is performed in the temperature range from [550] 500 to [650] 700°C.

Sub B6 21. (Amended) A method according to claim 17, wherein the heat treatment [in the step] during gettering is furnace annealing.

22. (Amended) A method according to claim 17, wherein the [silicon-containing] amorphous semiconductor film [contains] comprises germanium.

A6 23. (Amended) A method according to claim 17, wherein the [catalyst] element which promotes crystallization is at least one element selected from the group of elements consisting of Ni, Co, Fe, Pd, Pt, Cu and Au.

Sub B7 25. (Amended) A method of manufacturing a semiconductor device, comprising:

A7 [a first step of] forming an amorphous semiconductor film [containing] comprising silicon [on] over a substrate having an insulating surface;

[a second step of] selectively introducing into the amorphous semiconductor film [a catalyst] an element [for promoting] which promotes [the] crystallization of the amorphous semiconductor film;

[a third step of] crystallizing at least a part of the amorphous semiconductor film by a heat treatment;

[a fourth step of] irradiating a laser light or an intense light to the [silicon-containing] semiconductor film obtained [in the third step] by crystallizing at least a part of the amorphous semiconductor film;

[a fifth step of selectively] introducing an impurity element belonging to Group 15 into at least one region selected in [silicon-containing] the semiconductor film obtained [in the fourth step] by irradiating a laser light or an intense light [an impurity element belonging to Group 15; and

[a sixth step of] gettering the [catalyst] element which promotes crystallization by a heat treatment to the region into which the impurity element is introduced,

wherein the heat treatment [in the sixth step] during gettering is performed in the temperature range not exceeding a glass transition point of the substrate.

26. (Amended) A method according to claim 25, wherein [the silicon-containing] a crystallized semiconductor film obtained [in the third step] by the gettering is a crystalline semiconductor film having grain boundaries.

Amend
27. (Amended) A method according to claim 25, wherein the heat treatment [in the fifth step] during gettering is performed in the temperature range from [550] 500 to [650] 700°C.

Sub B8
29. (Amended) A method according to claim 25, wherein the heat treatment [in the step] during gettering is furnace annealing.

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30. (Amended) A method according to claim 25, wherein the [silicon-containing] amorphous semiconductor film [contains] comprises germanium.

31. (Amended) A method according to claim 25, wherein the [catalyst] element which promotes crystallization is at least one element selected from the group of elements consisting of Ni, Co, Fe, Pd, Pt, Cu and Au.

Please add new claims 33 through 74 as follows:

A9 Sub D13
--33. (New) A method according to claim 1, wherein said step of introducing an impurity element belonging to Group 15 is performed by plasma doping.

34. (New) A method according to claim 8, wherein a dose of said phosphorous (P) is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

35. (New) A method according to claim 8, wherein a concentration of said phosphorous is a digit higher than a concentration of said element which promotes crystallization.

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Sub D14
~~36. (New) A method according to claim 9, wherein said step of introducing an impurity element belonging to Group 15 is performed by plasma doping.~~

37. (New) A method according to claim 16, wherein a dose of said phosphorous is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

38. (New) A method according to claim 16, wherein a concentration of said phosphorous is a digit higher than a concentration of said element which promotes crystallization.

Sub D15
~~39. (New) A method according to claim 17, wherein said step of introducing an impurity element belonging to Group 15 is performed by plasma doping.~~

40. (New) A method according to claim 24, wherein a dose of said phosphorous is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

41. (New) A method according to claim 24, wherein a concentration of said phosphorus is a digit higher than a concentration of said element which promotes crystallization.

AA Cont Sub D161
~~42. (New) A method according to claim 25, wherein said step of introducing an impurity element belonging to Group 15 is performed by plasma doping.~~

43. (New) A method according to claim 32, wherein a dose of said phosphorous is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

44. (New) A method according to claim 32, wherein a concentration of said phosphorous is a digit higher than a concentration of said element which promotes crystallization.

Sub D9
~~45. (New) A method of manufacturing a semiconductor device, comprising:~~

forming an amorphous semiconductor film over a substrate having an insulating surface;

introducing into the amorphous semiconductor film an element which promotes crystallization of the amorphous semiconductor film;

crystallizing the amorphous semiconductor film by a heat treatment;

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introducing an impurity element belonging to Group 15 into at least one region selected in the crystallized semiconductor film obtained in the step of crystallizing the amorphous semiconductor film;

gettering the element which promotes crystallization by heat treatment into the region into which the impurity element is introduced;

patterning said crystallized semiconductor film into island-shape thereby removing said region into which the impurity element is introduced;

forming a gate insulating film over island-shaped semiconductor film obtained by patterning;

forming at least one gate electrode comprising a metal on said gate insulating film;

doping an impurity into at least a part of said island-shaped semiconductor film to form a lightly doped drain region; and

forming at least a source region and a drain region by doping an impurity into at least a part of said island-shaped semiconductor film,

wherein the heat treatment during gettering is performed in a temperature range not exceeding a glass transition point of the substrate.

46. (New) A method according to claim 45, wherein the heat treatment during gettering is performed in the temperature range from 500 to 700°C.

47. (New) A method according to claim 45, wherein the element which promotes crystallization is at least one element selected from the group of elements consisting of Ni, Co, Fe, Pd, Pt, Cu and Au.

48. (New) A method according to claim 45, wherein the impurity element belonging to Group 15 is at least one element selected from the group of elements consisting of P, N, As, Sb, and Bi.

Sub D19 49. (New) A method according to claim 45, wherein said step of introducing an impurity element belonging to Group 15 is performed by plasma doping.

50. (New) A method according to claim 48, wherein a dose of said phosphorus is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

Agent 51. (New) A method according to claim 48, wherein a concentration of said phosphorous is a digit higher than a concentration of said element which promotes crystallization.

Sub B10 52. (New) A method of manufacturing a semiconductor device, comprising:
forming an amorphous semiconductor film over a substrate having an insulating surface;
introducing into the amorphous semiconductor film an element which promotes crystallization of the amorphous semiconductor film;
crystallizing the amorphous semiconductor film by a heat treatment;

introducing an impurity element belonging to Group 15 into at least one region selected in the crystallized semiconductor film obtained by crystallizing the amorphous semiconductor film;

gettering the element which promotes crystallization by heat treatment into the region into which the impurity is introduced; and

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patterning said crystallized semiconductor film into island-shape thereby removing said region into which the impurity element is introduced;

forming a gate insulating film over island-shaped semiconductor film obtained by patterning;

forming at least one gate electrode comprising a metal on said gate insulating film;

doping an impurity into at least a part of said island-shaped semiconductor film to form a lightly doped drain region;

forming at least a source region and a drain region by doping an impurity into at least a part of said island-shaped semiconductor film;

forming an interlayer insulating film comprising silicon over said gate electrode;

forming an interlayer insulating film comprising organic resin film over said interlayer insulating film; and

forming a pixel electrode that is electrically connected to said source region or drain region through a contact hole over said interlayer film;

wherein the heat treatment during gettering is performed in a temperature range not exceeding a glass transition point of the substrate.

53. (New) A method according to claim 52, wherein the heat treatment during gettering is performed in the temperature range from 500 to 700°C.

54. (New) A method according to claim 52, wherein the amorphous semiconductor film comprises germanium.

55. (New) A method according to claim 52, wherein the element which promotes crystallization is at least one element selected from the group of elements consisting of Ni, Co, Fe, Pd, Pt, Cu and Au.

56. (New) A method according to claim 52, wherein the impurity element belonging to Group 15 is at least one element selected from the group of elements consisting of P, N, As, Sb, and Bi.

Sub D22 57. (New) A method according to claim 52, wherein said step of introducing an impurity element belonging to Group 15 is performed by plasma doping.

58. (New) A method according to claim 56, wherein a dose of said phosphorous is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

pg 12 59. (New) A method according to claim 56, wherein a concentration of said phosphorous is a digit higher than a concentration of said element which promotes crystallization.

60. (New) A method of manufacturing a semiconductor device, comprising:

forming a base film over a substrate having an insulating surface;

forming a gate electrode over said base film;

forming a gate insulating film over said gate electrode;

forming an amorphous semiconductor film over said gate insulating film;

forming a film comprising nickel over said amorphous semiconductor film;

heating said amorphous semiconductor film thereby
crystallizing said amorphous semiconductor film;

introducing an element for gettering said nickel into at
least a region selected in a crystallized semiconductor film
obtained by heating thereby crystallizing said amorphous
semiconductor film;

heating said semiconductor film thereby gettering said
nickel into the region selected in said crystallized
semiconductor film;

HA *cont*
patterning said crystallized semiconductor film thereby
forming an active layer; and

forming a channel stopper over said active layer,

wherein said gate electrode comprises a material that is
resistant to temperatures present during heating.

61. (New) A method according to claim 60, wherein the
step of heating during gettering is performed in the temperature
range from 500 to 700°C.

62. (New) A method according to claim 60, wherein the
impurity element belonging to Group 15 is at least one element
selected from the group of elements consisting of P, N, As, Sb,
and Bi.

63. (New) A method according to claim 60, wherein said step of introducing said element is performed by plasma doping.

64. (New) A method according to claim 62, wherein a dose of said phosphorous is set in a range from 1×10^{13} ions/cm² to 5×10^{14} ions/cm².

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65. (New) A method according to claim 62, wherein a concentration of said phosphorous is a digit higher than a concentration of said nickel.

66. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is an electroluminescent (EL) display device.

67. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a video camera.

68. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a still camera.

69. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a projector.

70. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a head mount display.

71. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a car navigation system.

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72. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a personal computer.

73. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a mobile computer.

74. (New) A method according to claims 1, 9, 17, 25, 45, 52 or 60 wherein said semiconductor device is a portable telephone.

REMARKS